November 8, 2005

TO: Sree Kumar
Design Division

Attention Joe Li

FROM: Rod H. Kubomoto
Water Resources Division

RIVER AVENUE STORM DRAIN
CITY OF LONG BEACH
HYDROLOGY REPORT

In response to your request dated October 5, 2005, this memorandum provides hydrologic information for the watershed tributary to the River Avenue storm drain in the City of Long Beach. The information in this completed hydrology report will assist in developing solutions to the flooding problems along West Arlington Street.

The watershed has a tributary area of 237 acres (0.37 square miles). Approximately 42.6 percent of the watershed is in the City of Long Beach with 57.4 percent in the City of Carson.

As agreed upon in our meeting with Design Division on November 1, 2005, we have included the analyses for the 2-, 5-, 10-, 25-year frequency design storms. The hydrologic models of the watershed were developed using the Watershed Modeling System and the Modified Rational Method. The hydrologic analyses are based on the standards and procedures described in the 1991 Public Works Hydrology/Sedimentation Manual and the 2002 Hydrology Manual Addendum.

Attachments

A-1. Hydrologic map showing existing drainage area boundaries tributary to the River Avenue storm drain.

A-2. Aerial photograph showing existing drainage area boundaries tributary to the River Avenue storm drain.

B-1. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 2-year frequency design storm.

B-2. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 5-year frequency design storm.

B-3. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 10-year frequency design storm.

B-4. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 25-year frequency design storm.

C. Supporting information including design parameters and street flooding analysis.

D. Design Division's request dated October 5, 2005.

Summary of Findings

- Flow rates from subareas 10B and 18C represent runoff from a 50-year frequency design storm due to sump conditions for the 10- and 25-year frequency storm analyses only.

- The adequately collected peak flow from a 2-year frequency storm for the area tributary to the River Avenue storm drain is 65 cubic feet per second (cfs).

- The adequately collected peak flow from a 5-year frequency storm for the area tributary to the River Avenue storm drain is 111 cubic feet per second (cfs).

- The adequately collected peak flow from a 10-year frequency storm for the area tributary to the River Avenue storm drain is 150 cubic feet per second (cfs).

- The adequately collected peak flow from a 25-year frequency storm for the area tributary to the River Avenue storm drain is 191 cubic feet per second (cfs).

If you have any questions, please contact Jessica Murphy at 458-6133.

JM:ac
C:\Documents and Settings\jmurphy\Desktop\River Avenue\files\River Ave Memo.doc

Attach.

cc: Water Resources (Araiza, Files)

November 8, 2005

TO: Sree Kumar
Design Division

Attention Joe Li

FROM: Rod H. Kubomoto
Water Resources Division

RIVER AVENUE STORM DRAIN
CITY OF LONG BEACH
HYDROLOGY REPORT

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B-1. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 2-year frequency design storm.

B-2. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 5-year frequency design storm.

B-3. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 10-year frequency design storm.

B-4. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 25-year frequency design storm.

C. Supporting information including design parameters and street flooding analysis.

D. Design Division's request dated October 5, 2005.

Summary of Findings

- Flow rates from subareas 10B and 18C represent runoff from a 50-year frequency design storm due to sump conditions for the 10- and 25-year frequency storm analyses only.

- The adequately collected peak flow from a 2-year frequency storm for the area tributary to the River Avenue storm drain is 65 cubic feet per second (cfs).

- The adequately collected peak flow from a 5-year frequency storm for the area tributary to the River Avenue storm drain is 111 cubic feet per second (cfs).

- The adequately collected peak flow from a 10-year frequency storm for the area tributary to the River Avenue storm drain is 150 cubic feet per second (cfs).

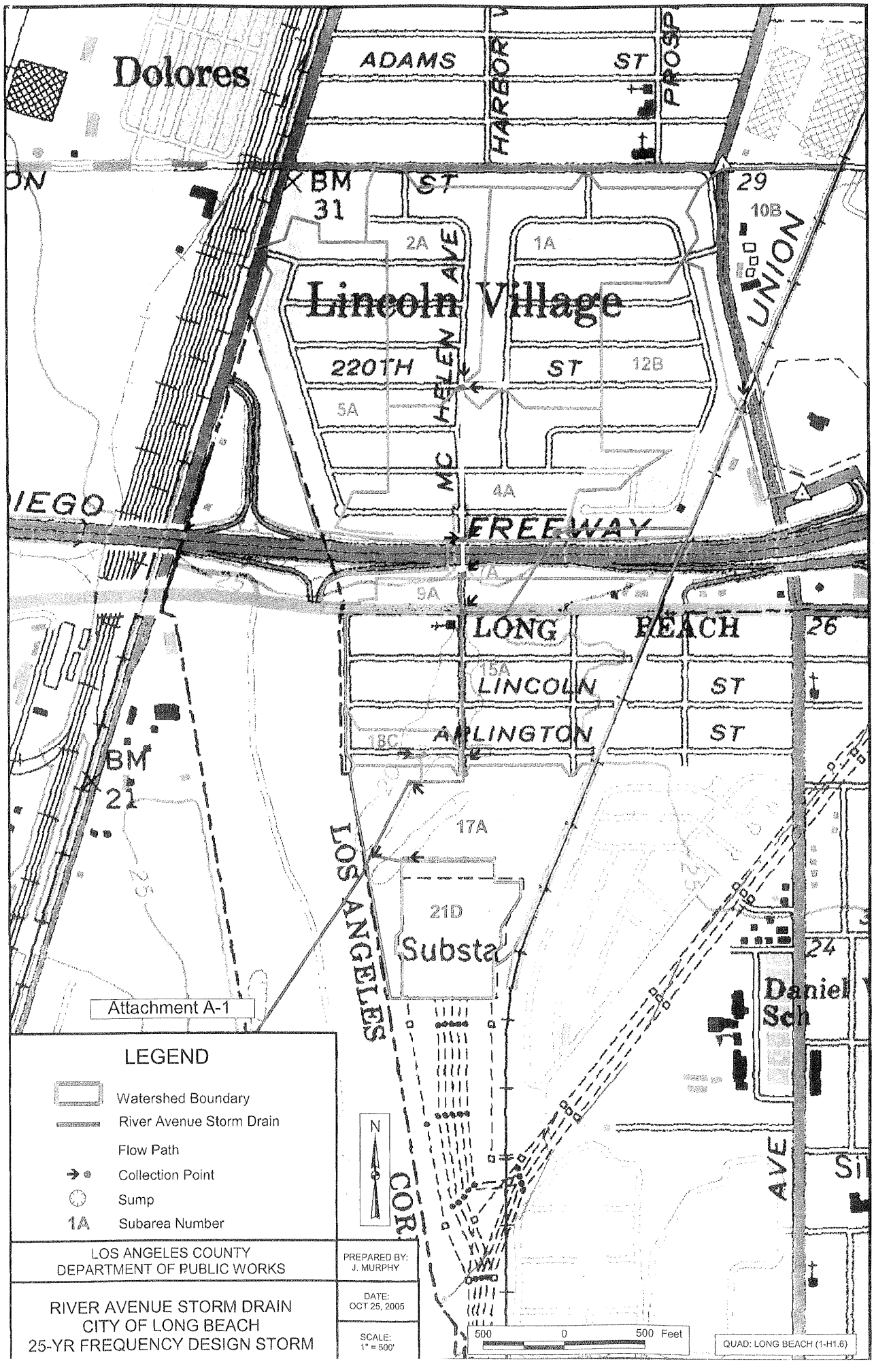
- The adequately collected peak flow from a 25-year frequency storm for the area tributary to the River Avenue storm drain is 191 cubic feet per second (cfs).

If you have any questions, please contact Jessica Murphy at 458-6133.

JM:ac
C:\Documents and Settings\jmurphy\Desktop\River Avenue\files\River Ave Memo.doc

Attach.

cc: Water Resources (Araiza, Files)


Dolores
ADAMS
ST
HARBOR
PROSP
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31
29
10B
2A
1A
Lincoln Village
HELEN AVE
UNION
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ST
12B
5A
MC
4A
FREEWAY
9A
LONG
BEACH
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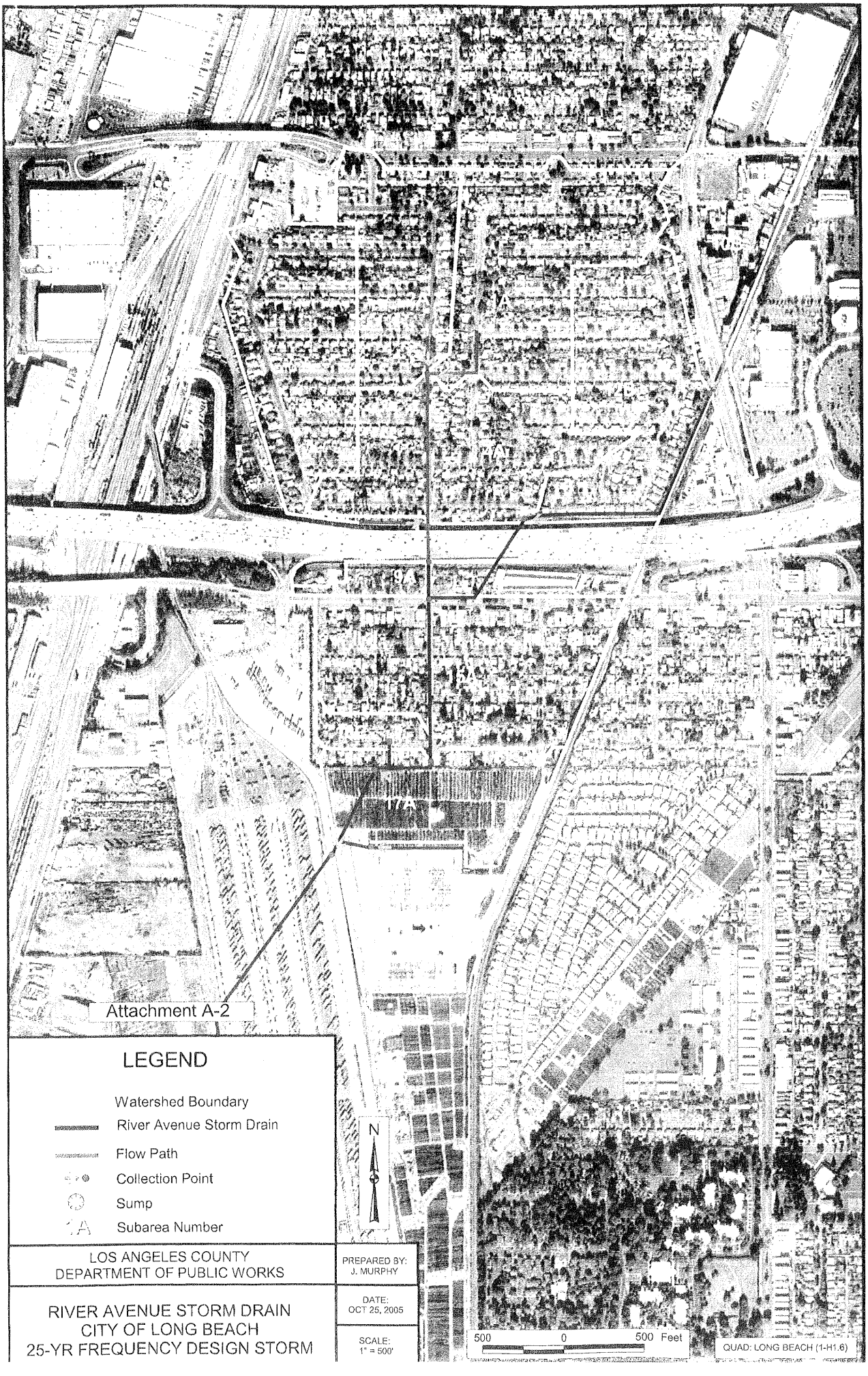
15A
LINCOLN
ST
ARLINGTON
ST
1BC
BM
21
17A
LOS ANGELES
21D
Substa
Daniel
Sch
AVE
Attachment A-1
LEGEND
Watershed Boundary
River Avenue Storm Drain
Flow Path
Collection Point
Sump
1A
Subarea Number
N
COR
500
0
500 Feet
QUAD: LONG BEACH (1-H1.6)
LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS
PREPARED BY:
J. MURPHY
RIVER AVENUE STORM DRAIN
CITY OF LONG BEACH
25-YR FREQUENCY DESIGN STORM
DATE:
OCT 25, 2005
SCALE:
1" = 500'


Attachment A-2
LEGEND
Watershed Boundary
River Avenue Storm Drain
Flow Path
Collection Point
Sump
Subarea Number
N
500 0 500 Feet
QUAD: LONG BEACH (1-H1.6)
LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS
PREPARED BY:
J. MURPHY
DATE:
OCT 25, 2005
SCALE:
1" = 500'
RIVER AVENUE STORM DRAIN
CITY OF LONG BEACH
25-YR FREQUENCY DESIGN STORM

County of Los Angeles Department of Public Works

ATTACHMENT B-1
HYDROLOGIC DATA

Project: River Avenue Storm Drain – City of Long Beach

Conveyance Types:

1. Natural Mountain
2. Natural Valley
3. Street
4. Pipe
5. Rectangular Channel
6. Trapezoidal Channel

2-Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area		Peak Q	
	Length (feet)	Type	Size (feet)		Subarea (acres)	Total (acres)	Subarea[1] (cfs)	Reach[2] (cfs)
Line A								
1A					29.5		10.6	
2A					19.3		6.9	
2A-4A	925	4	2.75	0.0010		48.8		17.6
4A					26.0		9.2	
5A					26.9		9.8	
5A-7A	214	4	3.75	0.0010		101.7		34.6
7A					9.4		4.4	
7A-9A	227	4	3.25	0.0020		111.1		38.8
9A					9.0		3.3	
9A - Line B	-	-	-	-		120.1		41.8
Line B					45.2		14.1	
Line B - 15A	983	4	4.25	0.0010		165.3		55.2
15A					33.1		9.5	
15A-17A	384	4	4.50	0.0010		198.4		61.9
17A					22.5		2.9	
17A - Line C	-	-	-	-		220.9		63.9
Line C					3.5		0.9	
Line C - Line D	581	4	4.50	0.0010		224.4		64.7
Line D					12.1		1.6	
Line D - Outlet	-	-	-	-		236.5		65.4
Line B								
10B					19.2		8.2	
10B -12B	1623	4	2.00	0.0040		19.2		8.2
12B					26.0		6.7	
12B - Line A	857	4	2.25	0.0020		45.2		14.1

[1]Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").
[2]Peak flow rate at the top of the reach for design of the conveyance.
[3]Flows resulting from a 50-year frequency rainfall

County of Los Angeles Department of Public Works

ATTACHMENT B-1
HYDROLOGIC DATA

Project: River Avenue Storm Drain – City of Long Beach

Conveyance Types:

1. Natural Mountain
2. Natural Valley
3. Street
4. Pipe
5. Rectangular Channel
6. Trapezoidal Channel

2-Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area		Peak Q	
	Length	Type	Size		Subarea	Total	Subarea[1]	Reach[2]
	(feet)		(feet)		(acres)	(acres)	(cfs)	(cfs)
Line C								
18C					3.5		0.9	
18C - Line A	253	4	2.00	0.0010		3.5		0.9
Line D								
21D					12.1		1.6	
21D - Line A	303	4	2.00	0.0024		12.1		1.6

[1]Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").
[2]Peak flow rate at the top of the reach for design of the conveyance.
[3]Flows resulting from a 50-year frequency rainfall

County of Los Angeles Department of Public Works

ATTACHMENT B-2
HYDROLOGIC DATA

Project: River Avenue Storm Drain – City of Long Beach

Conveyance Types:

1. Natural Mountain
2. Natural Valley
3. Street
4. Pipe
5. Rectangular Channel
6. Trapezoidal Channel

5-Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area		Peak Q	
	Length (feet)	Type	Size (feet)		Subarea (acres)	Total (acres)	Subarea[1] (cfs)	Reach[2] (cfs)
Line A								
1A					29.5		18.4	
2A					19.3		12.0	
2A-4A	925	4	3.50	0.0010		48.8		30.5
4A					26.0		16.4	
5A					26.9		17.0	
5A-7A	214	4	4.50	0.0010		101.7		61.5
7A					9.4		7.0	
7A-9A	227	4	4.00	0.0020		111.1		68.1
9A					9.0		5.0	
9A - Line B	-	-	-	-		120.1		72.8
Line B					45.2		22.3	
Line B - 15A	983	4	5.25	0.0010		165.3		94.0
15A					33.1		14.3	
15A-17A	384	4	5.50	0.0010		198.4		105.0
17A					22.5		4.4	
17A - Line C	-	-	-	-		220.9		108.4
Line C					3.5		1.6	
Line C - Line D	581	4	5.50	0.0010		224.4		109.5
Line D					12.1		2.4	
Line D - Outlet	-	-	-	-		236.5		110.9
Line B								
10B					19.2		13.3	
10B -12B	1623	4	2.00	0.0040		19.2		13.3
12B					26.0		10.1	
12B - Line A	857	4	2.75	0.0020		45.2		22.3

[1]Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").
[2]Peak flow rate at the top of the reach for design of the conveyance.
[3]Flows resulting from a 50-year frequency rainfall

County of Los Angeles Department of Public Works

ATTACHMENT B-2
HYDROLOGIC DATA

Project: River Avenue Storm Drain – City of Long Beach

Conveyance Types:

1. Natural Mountain
2. Natural Valley
3. Street
4. Pipe
5. Rectangular Channel
6. Trapezoidal Channel

5-Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area		Peak Q	
	Length (feet)	Type	Size (feet)		Subarea (acres)	Total (acres)	Subarea[1] (cfs)	Reach[2] (cfs)
Line C								
18C					3.5		1.6	
18C - Line A	253	4	2.00	0.0010		3.5		1.6
Line D								
21D					12.1		2.4	
21D - Line A	303	4	2.00	0.0024		12.1		2.4

[1]Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").
[2]Peak flow rate at the top of the reach for design of the conveyance.
[3]Flows resulting from a 50-year frequency rainfall

County of Los Angeles Department of Public Works

ATTACHMENT B-3
HYDROLOGIC DATA

Project: River Avenue Storm Drain – City of Long Beach

Conveyance Types:

1. Natural Mountain
2. Natural Valley
3. Street
4. Pipe
5. Rectangular Channel
6. Trapezoidal Channel

10-Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area		Peak Q	
	Length (feet)	Type	Size (feet)		Subarea (acres)	Total (acres)	Subarea[1] (cfs)	Reach[2] (cfs)
Line A								
1A					29.5		23.5	
2A					19.3		15.4	
2A-4A	925	4	3.75	0.0010		48.8		38.9
4A					26.0		22.7	
5A					26.9		21.6	
5A-7A	214	4	5.00	0.0010		101.7		80.1
7A					9.4		9.2	
7A-9A	227	4	4.50	0.0020		111.1		88.6
9A					9.0		6.5	
9A - Line B	-	-	-	-		120.1		94.6
Line B					45.2		36.8	
Line B - 15A	983	4	6.00	0.0010		165.3		129.7
15A					33.1		17.8	
15A-17A	384	4	6.00	0.0010		198.4		143.5
17A					22.5		5.7	
17A - Line C	-	-	-	-		220.9		147.4
Line C					3.5		4.5[3]	
Line C - Line D	581	4	6.25	0.0010		224.4		148.4
Line D					12.1		3.1	
Line D - Outlet	-	-	-	-		236.5		150.4
Line B								
10B					19.2		25.8	
10B -12B	1623	4	2.50	0.0040		19.2		25.8[3]
12B					26.0		12.6	
12B - Line A	857	4	3.25	0.0020		45.2		36.8

[1]Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").
[2]Peak flow rate at the top of the reach for design of the conveyance.
[3]Flows resulting from a 50-year frequency rainfall

County of Los Angeles Department of Public Works

ATTACHMENT B-3
HYDROLOGIC DATA

Project: River Avenue Storm Drain – City of Long Beach

Conveyance Types:

1. Natural Mountain
2. Natural Valley
3. Street
4. Pipe
5. Rectangular Channel
6. Trapezoidal Channel

10-Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area		Peak Q	
	Length	Type	Size		Subarea	Total	Subarea[1]	Reach[2]
	(feet)		(feet)		(acres)	(acres)	(cfs)	(cfs)
Line C								
18C					3.5		4.5	
18C - Line A	253	4	2.00	0.0010		3.5		4.5[3]
Line D								
21D					12.1		3.1	
21D - Line A	303	4	2.00	0.0024		12.1		3.1

[1]Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").
[2]Peak flow rate at the top of the reach for design of the conveyance.
[3]Flows resulting from a 50-year frequency rainfall

County of Los Angeles Department of Public Works

ATTACHMENT B-4
HYDROLOGIC DATA

Project: River Avenue Storm Drain – City of Long Beach

Conveyance Types:

1. Natural Mountain
2. Natural Valley
3. Street
4. Pipe
5. Rectangular Channel
6. Trapezoidal Channel

25-Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area		Peak Q	
	Length (feet)	Type	Size (feet)		Subarea (acres)	Total (acres)	Subarea[1] (cfs)	Reach[2] (cfs)
Line A								
1A					29.5		29.9	
2A					19.3		20.3	
2A-4A	925	4	4.25	0.0010		48.8		50.2
4A					26.0		31.9	
5A					26.9		27.5	
5A-7A	214	4	5.50	0.0010		101.7		105.6
7A					9.4		12.6	
7A-9A	227	4	5.00	0.0020		111.1		117.0
9A					9.0		9.2	
9A - Line B	-	-	-	-		120.1		125.4
Line B					45.2		40.7	
Line B - 15A	983	4	6.50	0.0010		165.3		163.8
15A					33.1		23.3	
15A-17A	384	4	6.75	0.0010		198.4		182.2
17A					22.5		8.6	
17A - Line C	-	-	-	-		220.9		188.6
Line C					3.5		4.5[3]	
Line C - Line D	581	4	6.75	0.0010		224.4		189.8
Line D					12.1		3.1	
Line D - Outlet	-	-	-	-		236.5		191.4
Line B								
10B					19.2		25.8	
10B -12B	1623	4	2.50	0.0040		19.2		25.8[3]
12B					26.0		16.7	
12B - Line A	857	4	3.50	0.0020		45.2		40.7

[1]Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").
[2]Peak flow rate at the top of the reach for design of the conveyance.
[3]Flows resulting from a 50-year frequency rainfall

County of Los Angeles Department of Public Works

ATTACHMENT B-4
HYDROLOGIC DATA

Project: River Avenue Storm Drain – City of Long Beach

Conveyance Types:

1. Natural Mountain
2. Natural Valley
3. Street
4. Pipe
5. Rectangular Channel
6. Trapezoidal Channel

25-Year Frequency Design Storm

Reach or Subarea	Preliminary Conveyance			Slope	Area		Peak Q	
	Length (feet)	Type	Size (feet)		Subarea (acres)	Total (acres)	Subarea[1] (cfs)	Reach[2] (cfs)
Line C								
18C					3.5		4.5	
18C - Line A	253	4	2.00	0.0010		3.5		4.5[3]
Line D								
21D					12.1		3.1	
21D - Line A	303	4	2.00	0.0024		12.1		3.1

[1]Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").
[2]Peak flow rate at the top of the reach for design of the conveyance.
[3]Flows resulting from a 50-year frequency rainfall

County of Los Angeles Department of Public Works

ATTACHMENT C
SUPPORTING INFORMATION

River Avenue Storm Drain – City of Long Beach

Design Parameters

This hydrology meets the policies and procedures established in the Public Works Hydrology Manual dated December 1991 and the 2002 Hydrology Manual Addendum.

The total watershed size is 237 acres. The assumed ultimate development in the watershed is 74 percent residential, 18 percent commercial/industrial and 8 percent nurseries.

As-built storm drain plans for the River Avenue storm drain were reviewed to determine the proper drain alignment and to aid in subarea delineation and routing. Storm drain slopes were obtained from as-built plans and used in the hydrologic model.

All reported flow rates are adequately collected runoff from 2-, 5-, 10- and 25-year frequency design storms.

Adequate collection assumes that the drainage system collects all incoming surface flows and that runoff will flow out of its appropriate subarea only at the collection point. It is assumed that any catch basins, culverts, and drains within the watershed have sufficient capacity to capture the runoff from 2-, 5-, 10-, and 25-year frequency design storms.

County of Los Angeles Department of Public Works

ATTACHMENT C (Con't)
SUPPORTING INFORMATION

River Avenue Storm Drain – City of Long Beach

Street Flooding Analysis – Existing Conditions

Street flow depths shown below are based on a 2-year frequency rainfall.

*Street flow depths:

A – Below top of curb
B – Above top of curb
C – Above property line
D – Above building line

Existing Conditions						
Reach or Subarea	Street Flow Depth*				Ponding	
	A	B	C	D	Depth	Duration
Line A						
2A-4A		X				
5A-7A			X			

County of Los Angeles Department of Public Works

ATTACHMENT C (Con't)
SUPPORTING INFORMATION

River Avenue Storm Drain – City of Long Beach

Street Flooding Analysis – Existing Conditions

Street flow depths shown below are based on a 5-year frequency rainfall.

*Street flow depths:

A – Below top of curb
B – Above top of curb
C – Above property line
D – Above building line

Existing Conditions						
Reach or Subarea	Street Flow Depth*				Ponding	
	A	B	C	D	Depth	Duration
Line A						
2A-4A			X			
5A-7A			X			

County of Los Angeles Department of Public Works

ATTACHMENT C (Con't)
SUPPORTING INFORMATION

River Avenue Storm Drain – City of Long Beach

Street Flooding Analysis – Existing Conditions

Street flow depths shown below are based on a 10-year frequency rainfall.

*Street flow depths:

A – Below top of curb
B – Above top of curb
C – Above property line
D – Above building line

Existing Conditions						
Reach or Subarea	Street Flow Depth*				Ponding	
	A	B	C	D	Depth	Duration
Line A						
2A-4A			X			
5A-7A			X			

County of Los Angeles Department of Public Works

ATTACHMENT C (Con't)
SUPPORTING INFORMATION

River Avenue Storm Drain – City of Long Beach

Street Flooding Analysis – Existing Conditions

Street flow depths shown below are based on a 25-year frequency rainfall.

*Street flow depths:

A – Below top of curb
B – Above top of curb
C – Above property line
D – Above building line

Existing Conditions						
Reach or Subarea	Street Flow Depth*				Ponding	
	A	B	C	D	Depth	Duration
Line A						
2A-4A			X			
5A-7A			X			

County of Los Angeles Department of Public Works

ATTACHMENT D
REQUEST FROM DESIGN DIVISION

October 5, 2005

TO: Rod H. Kubomoto
Water Resources Division

Attention Iraj Nasseri

FROM: Sree Kumar
Design Division

RIVER AVENUE STORM DRAIN
REQUEST FOR UPDATED HYDROLOGY REPORT
PCA DLBCH15727

Please provide the updated hydrology for the River Avenue Storm Drain located in the City of Long Beach (T.G. 764 J-7, 765 A-7, 794 J-1, 795 A-1). Public Works is working as a consultant for the City of Long Beach needed to provide a Project Design Concept to mitigate flooding in the subject area. It should be noted that the City drain outlets into Dominguez Channel. The existing channel in this vicinity is tide-influenced with an outlet hydraulic control elevation of 12.4 feet mean sea level.

Attached are the following for your use and reference:

- Site Map
- As-built Plans (Drawing No. B-1938, provided by the City of Long Beach)
- Existing Hydrology Report (provided by the City of Long Beach)
- Existing Hydrology Map (provided by the City of Long Beach)

Per our discussion between Iraj Nasseri of your staff and Mike Soliman of Design Division, Water Resources Division shall complete the following tasks within the budget of $15,000:

- Provide updated hydrological models based on the most current modified rational hydrological methods to identify appropriate design hydrology for various design frequencies. Please complete the updated Hydrology Report by October 27, 2005.

- Based on the results of the Hydrology Report, develop, if needed, analytical what if scenarios for the purpose of designing detention facilities (linear or other multi-use options).

If you have any questions, please contact Joe Li at Extension 7839 or Patrick Holland at Extension 7930.

PH:sn
D-2\P:\DDPUB\DRAINAGE\PROJECTSD2\LONGBEACH\SPECIALPROJECT\HYDROLOGYREQUEST

Attach.

cc: Design (Li)